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(71) Applicant(s)
Stuart Charles Aiken
1 Priory Barns, Church Road, KETTON, Stamford, PE9 3RD, United Kingdom

(72) Inventor(s)
Stuart Charles Aiken

(74) Agent and/or Address for Service
Laurence Shaw & Associates
5th Floor, Metropolitan House, 1 Hagley Road, Edgbaston, BIRMINGHAM, B16 8TG, United Kingdom

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B7W WFE
B7G G7AX G7X

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(58) Field of Search
UK CL (Edition P) B7W WFC WFE WFF
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(54) Abstract Title
Modular cargo/passenger units for aircraft

(57) Cargo and/or passenger containing modules 15, 16, 17 may be pre-loaded, prior to placing on-board an aircraft, eg. at terminal buildings positioned around a turntable on which the aircraft is positioned (fig.7). Mixed cargo and passenger modules may be loaded into an aircraft fuselage, and the modules may be moved inside the fuselage on runners, prior to being locked into position. The modules may be incorporated into the structure of the aircraft. Passenger modules may have two decks, be provided with fold-down sides for access, and incorporate catering, washroom and/or entertainment facilities, and windows and doors (positioned to correspond to those of the aircraft) or video screens. The modules may be interconnected.

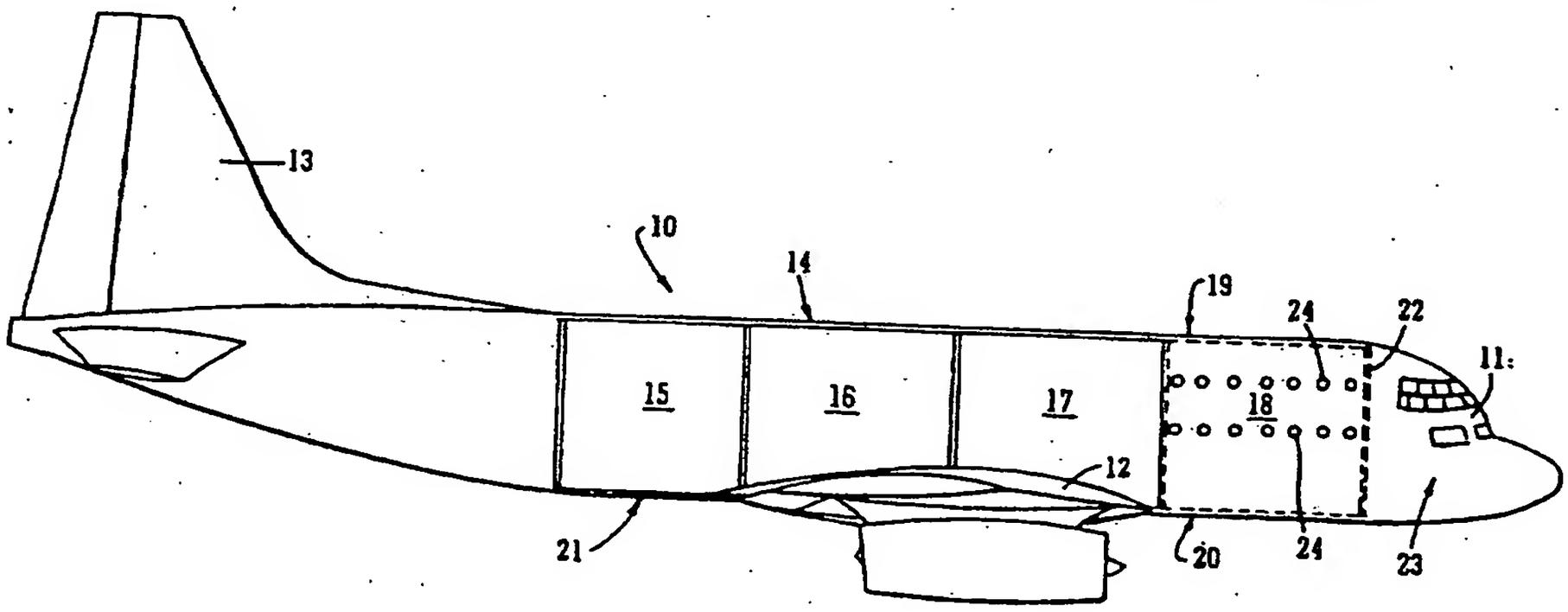

FIG. 1

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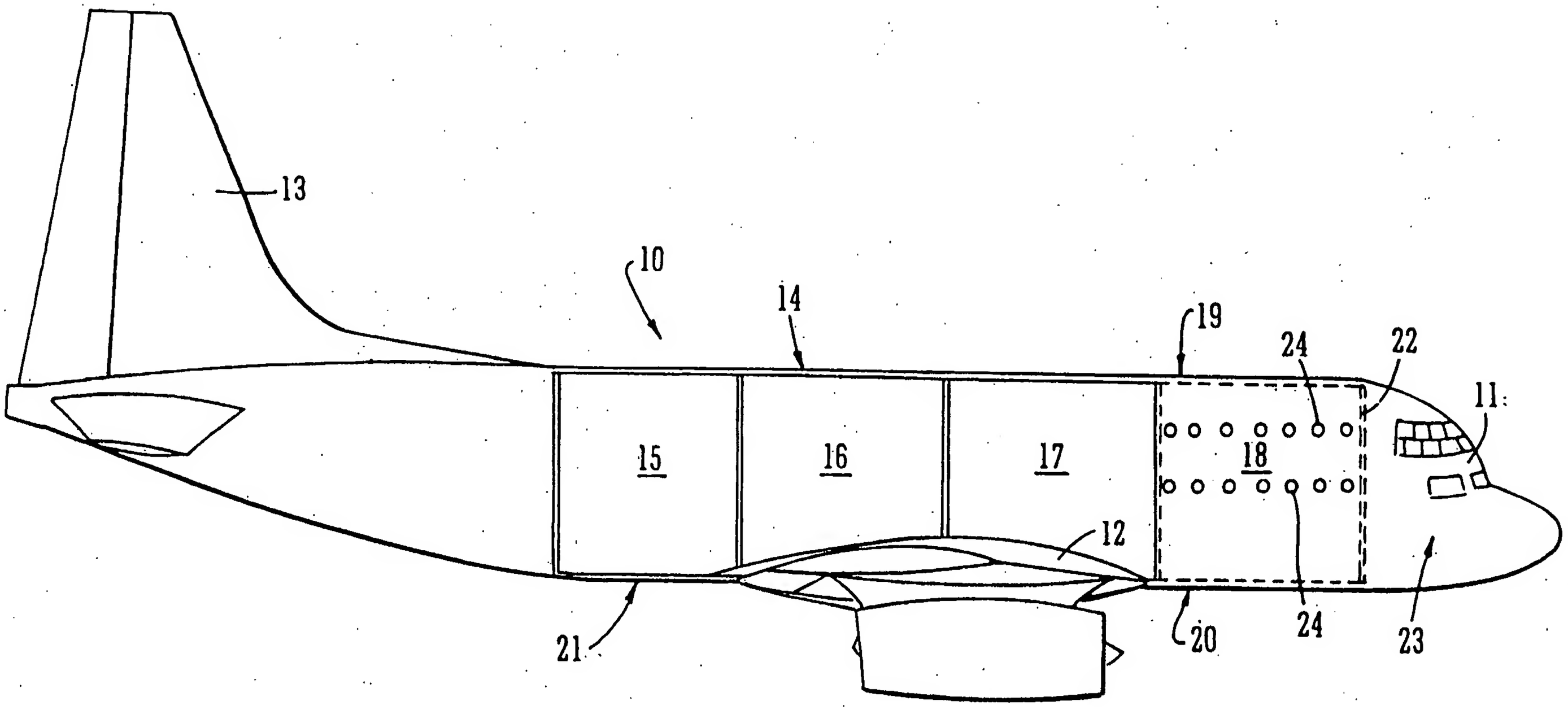

FIG. 1

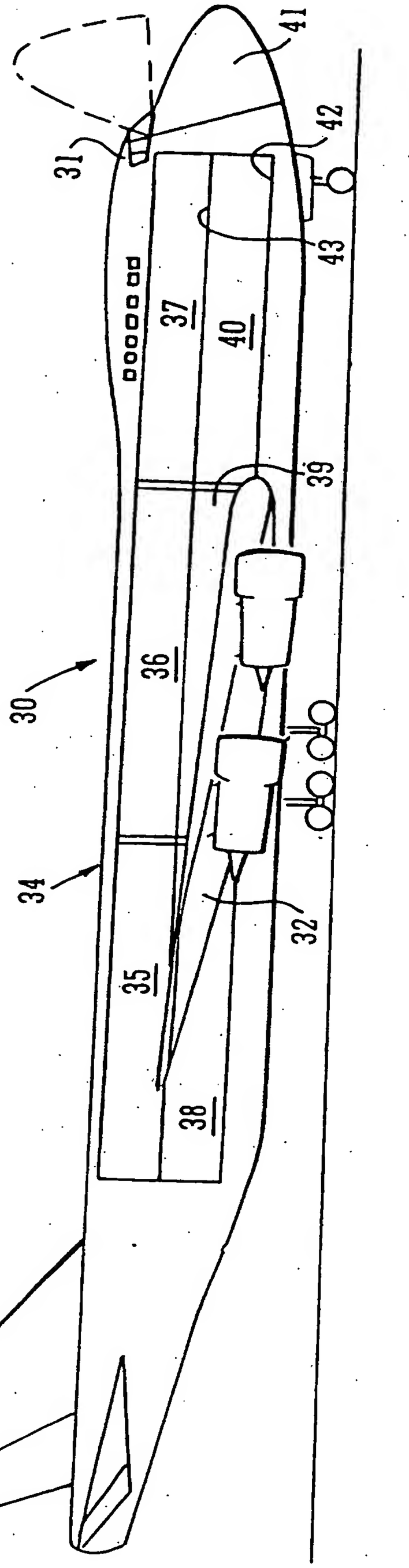

FIG. 2

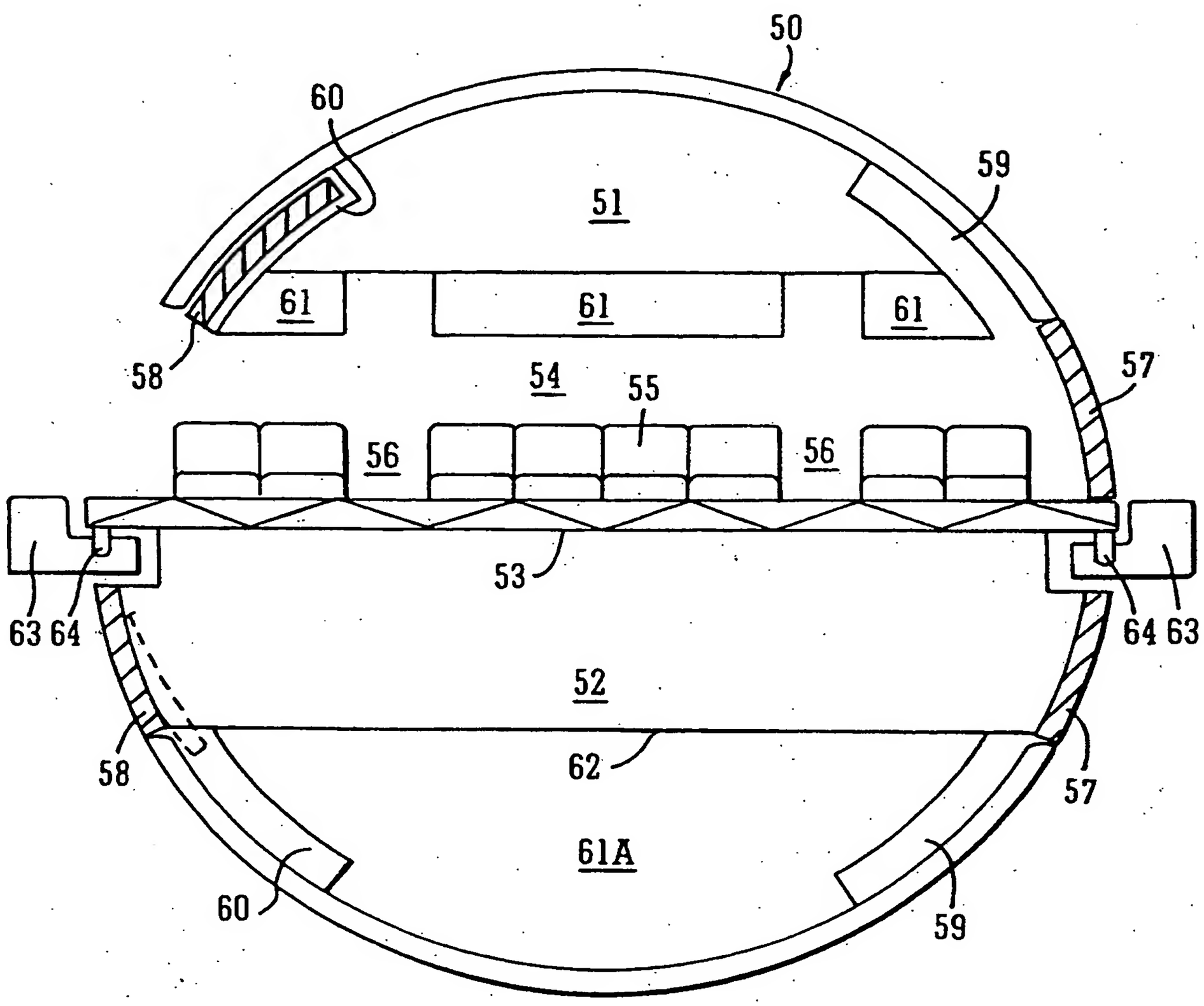
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FIG. 3

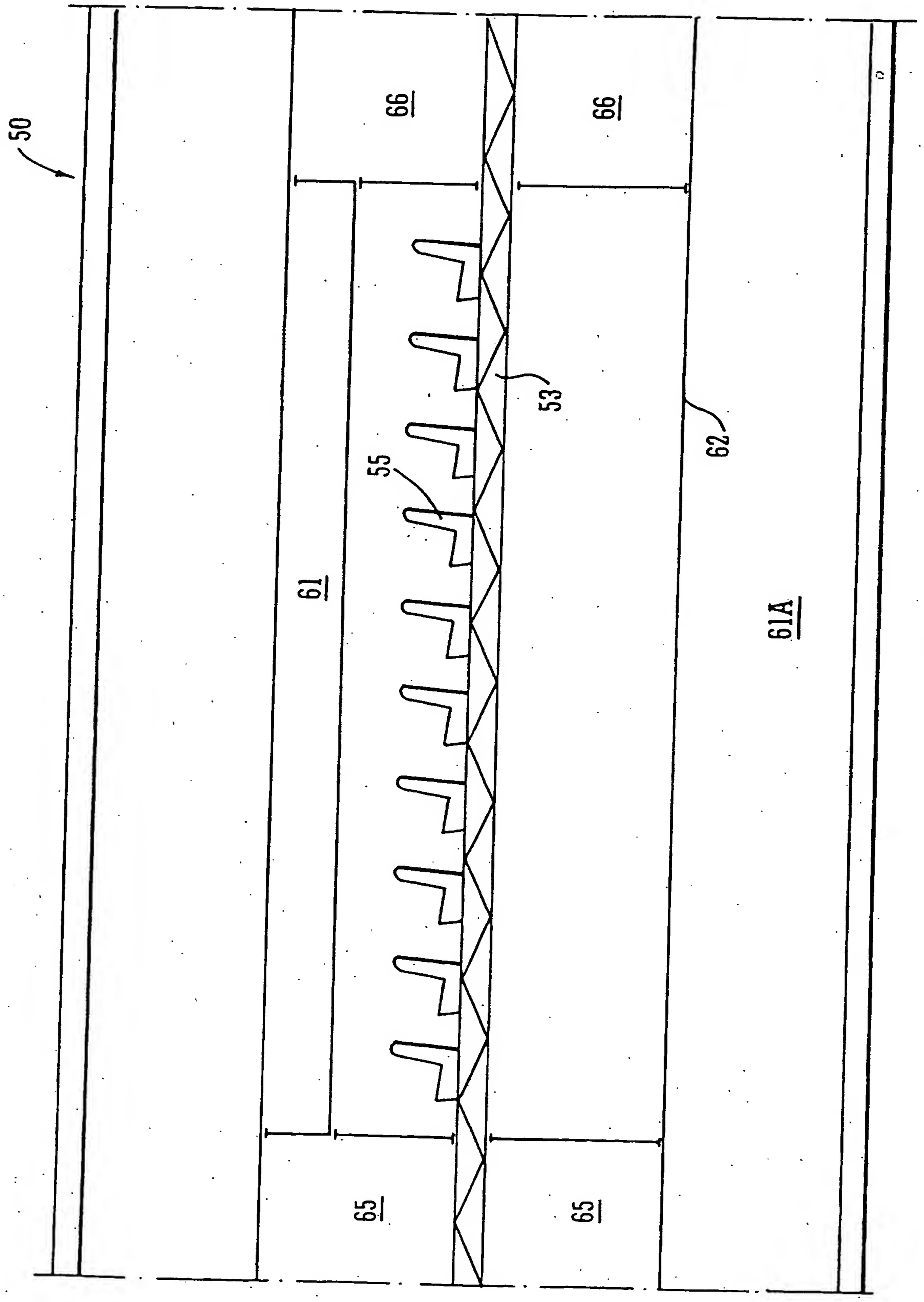

FIG. 4

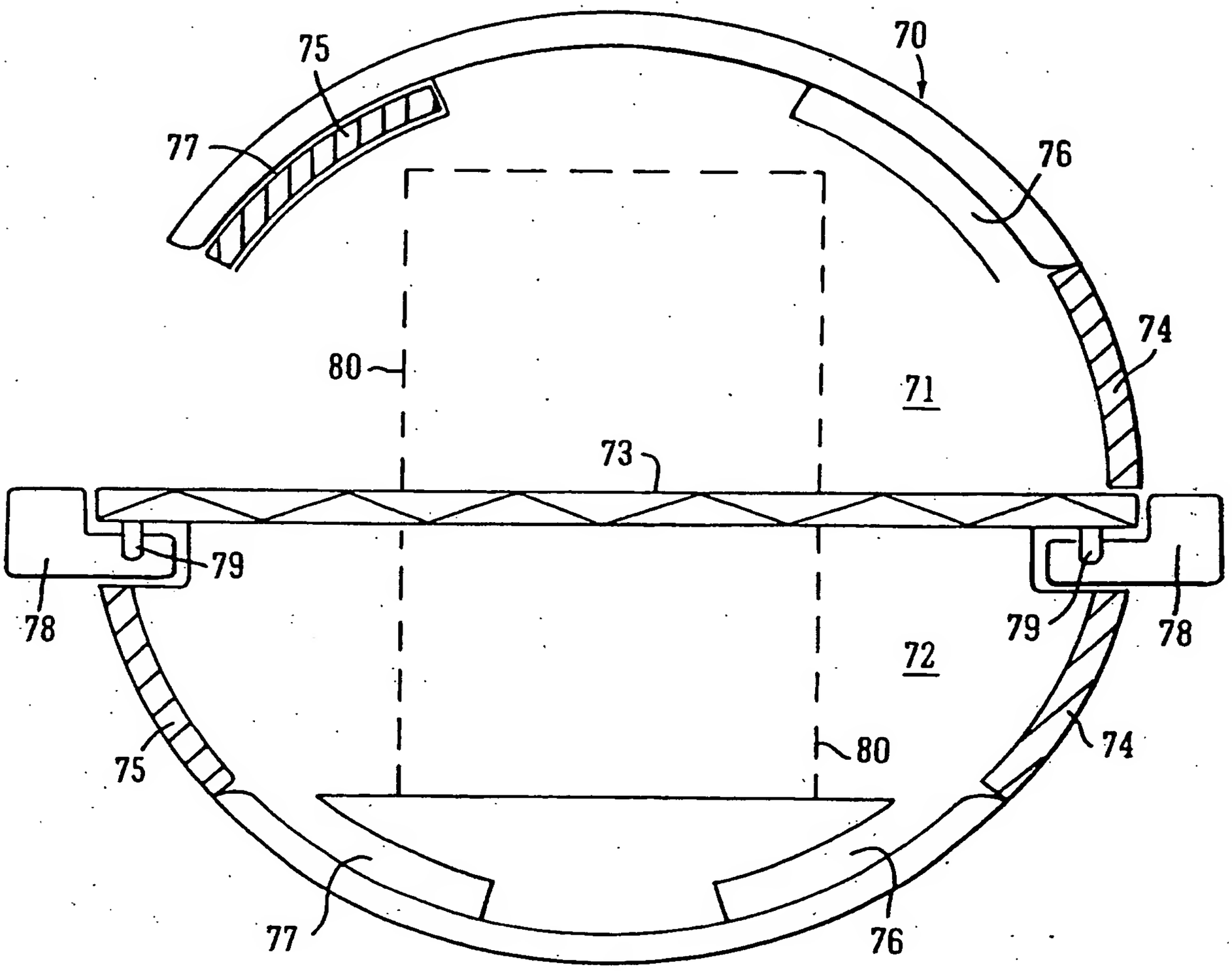

FIG. 5

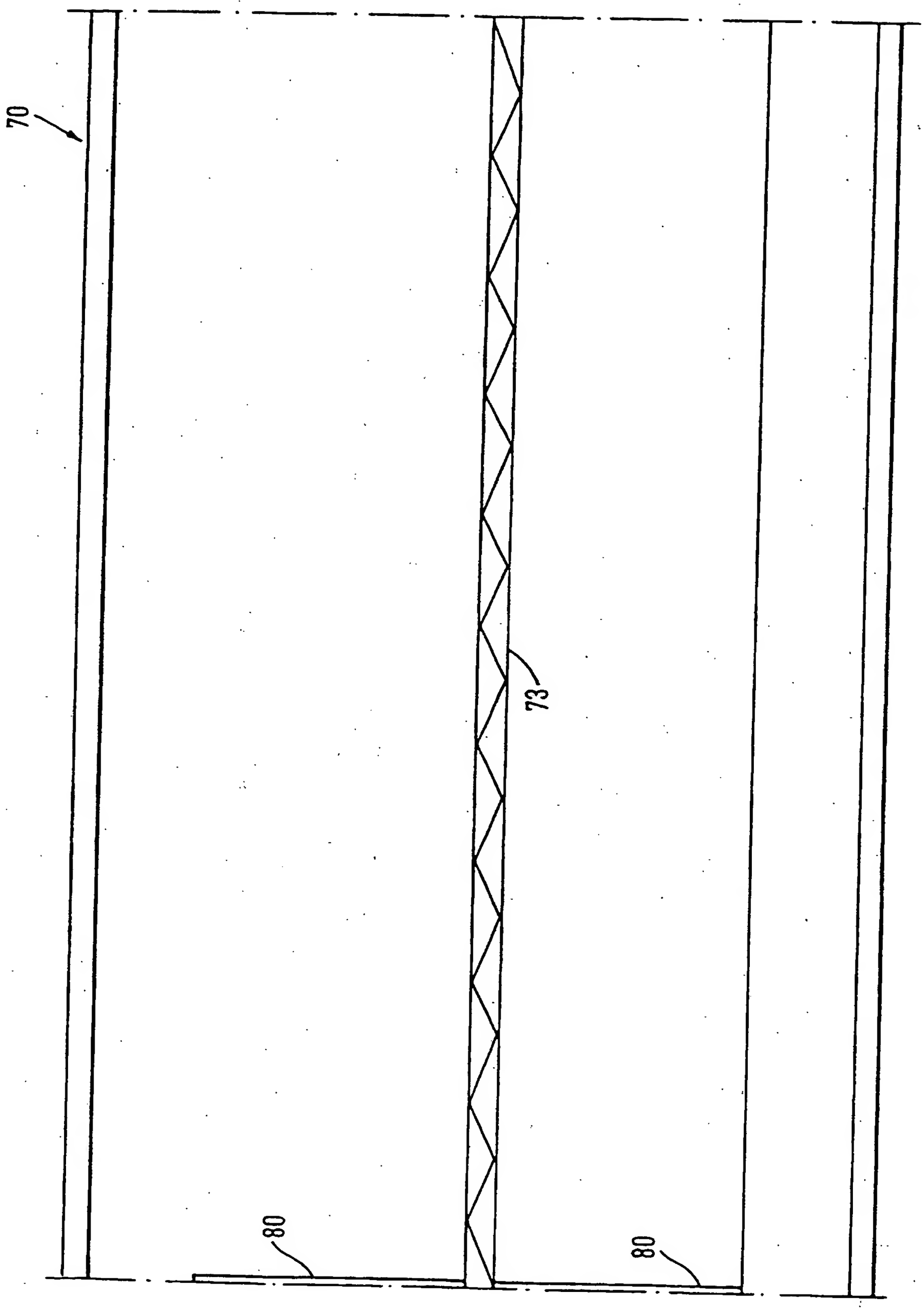

FIG. 6

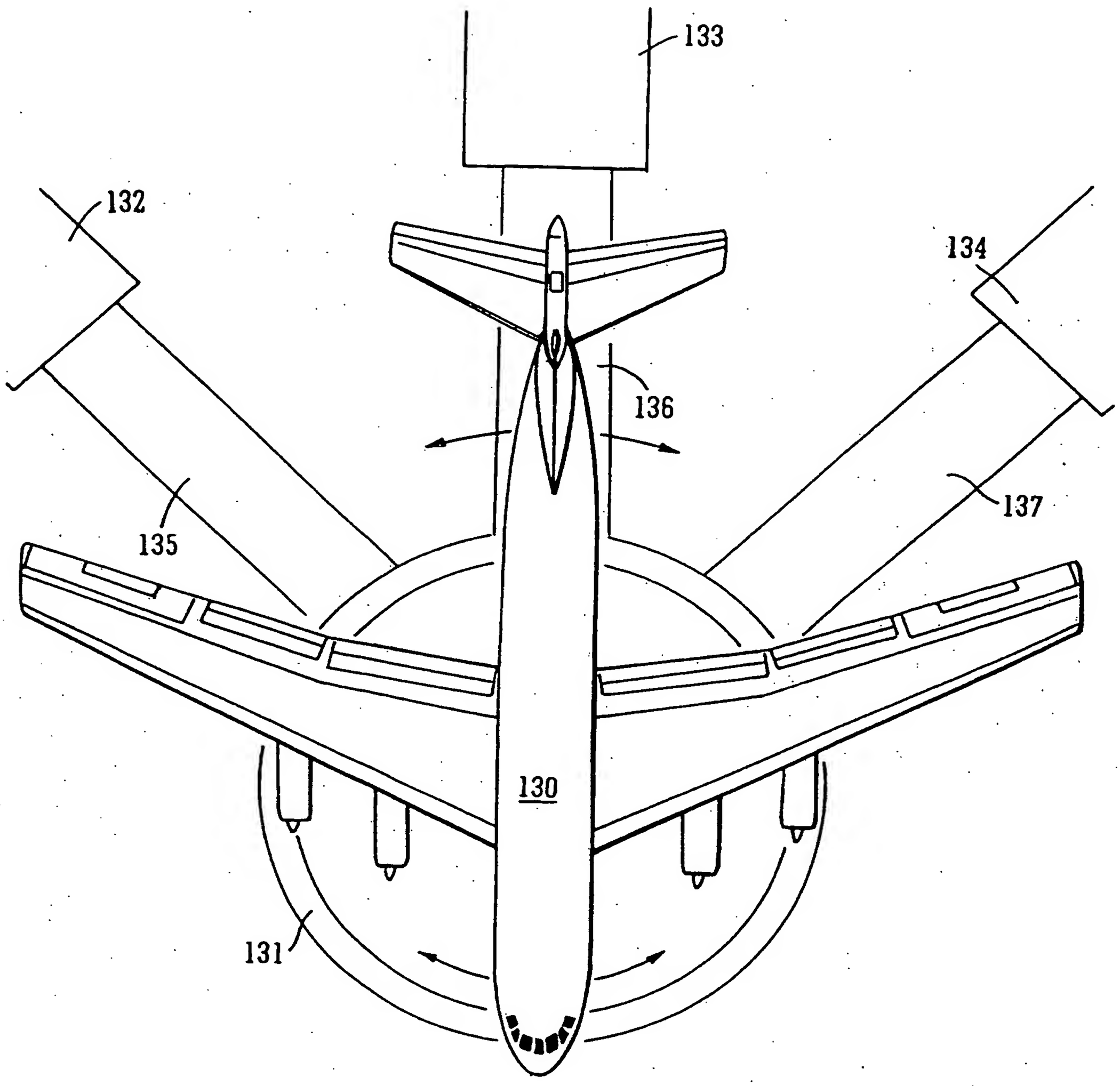

FIG.7

AIRCRAFT MODULES

This invention relates to a modular aircraft and to the modules for such an aircraft.

Air traffic has grown almost inexorably over the last 50 years and is predicted to continue growing for the foreseeable future at a rate of 5% per annum or even more. Airports and air traffic control systems in many parts of the world are already approaching saturation or have reached saturation point in their ability to handle more flights daily. There is, therefore, clearly a limit which is being approached beyond which increased traffic cannot be catered for by increased numbers of flights. Despite this saturation problem, there are many instances when, for a number of reasons, aircraft are flying with significant numbers of empty seats and there is an ongoing need to reduce the cost per passenger mile.

The saturation problem can be eased to a degree by the building of ever larger aircraft whereby more traffic can be carried without increase in the number of flights. However, larger aircraft bring their own set of problems, one serious one of which is the ability of existing airports to deal with larger aircraft and larger numbers of passengers embarking or disembarking at the same time. Fast turnaround times are essential to enable expensive modern aircraft to be used effectively and economically and unloading and loading of passengers and their luggage, cleaning, supplying and servicing the aircraft need to be carried out in as short a time as possible. Clearly, merely increasing the size of an aircraft creates as many problems as it solves. Terminal gates would need to be

expensively redesigned to accommodate larger aircraft - assuming space available permits such expansion.

The present invention aims to alleviate these problems.

Accordingly, in one aspect the invention provides an aircraft having a fuselage to contain a plurality of modules, each module being designed to accommodate passengers or cargo and being removable from the fuselage for loading and unloading to take place remote from the fuselage.

The modules may be of identical dimensions externally and may be designed internally for passenger or cargo use. Thus an aircraft fuselage may be loaded with passenger modules only, cargo modules only or a mixture of both.

Passenger modules may comprise, for example, two or more decks and may be used at the terminal gate or elsewhere as the departure lounge. Thus the modules may be designed, e.g. with fold-down sides, whereby they may be accessed by passengers instead of a conventional departure lounge. Thus the sides may extend outwardly to provide additional gangways and reduce congestion and will be retracted prior to loading in the fuselage. At the appropriate time, the loaded module can be closed and transported by a suitable transporter to the aircraft and loaded into the fuselage shell. Alternatively, the loaded module may be inserted directly into the aircraft fuselage from a specially designed terminal building.

When in position in the fuselage, each module may be a self-contained unit equipped with its own catering and washroom facilities, entertainment means and cabin staff. Alternatively, or additionally, when loaded, the modules may be interconnected to form a more conventional aircraft interior layout. If desired, each passenger module may be independently pressurised making it unnecessary to pressurise the main fuselage.

The passenger modules may have doors and windows corresponding to the door and window positions in the aircraft fuselage and the doors may be automatically operable together for emergency evacuation procedures. Thus most doors in the aircraft may be for emergency use only. Alternatively, windows may be dispensed with and replaced by video screens at the side of, or in front of, passenger seats. Cameras may be positioned strategically, e.g. looking out from the cockpit area, and each side of the aircraft, whereby several channels of vision may be available to the passenger. Where the need for windows is dispensed with there will be benefits including simpler engineering for less weight, ease of adapting to different usages and easier cleaning and servicing. Passengers will also be cocooned from module loading and unloading activity.

The modules may be loaded into and unloaded from the aircraft fuselage at one or more loading points in the fuselage. These will depend largely on the design of the fuselage and may, for example, be from underneath at the back or front or from above at the front. Alternatively, the front of the aircraft may hinge, e.g. to one side, allowing direct horizontal access to the fuselage.

Inside the fuselage, the modules may move on runners attached to the fuselage interior and may be locked in their required positions to the fuselage and/or to each other. The

aircraft may be designed to incorporate modules in its structural rigidity, in which case it must be loaded with modules, even if empty, in order to fly. Alternatively, the aircraft may be designed so that the modules play no part in its structural rigidity requirements.

Some parts of the aircraft may be permanently fitted out to cater for aerodynamic design or special requirements. For example, a first class passenger section may extend underneath or behind the cockpit area or an area may be provided with conventional passenger access. Alternatively, specially designed modules may be fitted into such areas.

In another aspect, the invention provides an aircraft module, the module having external dimensions to fit into the fuselage of an aircraft and having means to slide within the aircraft fuselage to a desired position and means to lock it to the fuselage at the desired position.

The module may be fitted internally for the carriage of passengers or the carriage of cargo or for military applications, e.g. transport, tanker, surveillance use, etc.

All modules are preferably of substantially identical exterior dimensions so that they are usable within the same design of aircraft fuselage. Thus, there are fewer variants of the basic aircraft required as all the options, whether passenger, cargo or military, can be built into the separate modules, thereby providing clear economic benefits.

As indicated above, the passenger modules may double as departure lounges and have retractable sides to provide easy access in that configuration. The passenger modules

may be individually customised, e.g. for first class, business class and economy use, for sleeping or, for example, as a bar.

A specific aircraft fuselage may be designed, for example, to carry two or more modules and, in passenger mode, each module may carry, for example, from 150 to 300 passengers.

Basically the same aircraft may be designed, if desired, to carry more or fewer modules, e.g. two passenger modules for shorter-haul flights.

The modules may be loaded in at least two different basic modes.

In a first mode, specially designed vehicles to carry the modules transport modules between the terminal and the aircraft. The terminal may be designed to accommodate the passenger modules in their opened, departure lounge form. This mode provides flexibility and is particularly suitable for, but not exclusively intended for use in, a smaller airport.

In a second mode, a specially designed, dedicated facility includes buildings to accommodate the modules and direct access for the modules to the aircraft, which is parked nearby. Thus, for example, there may be fixed loading mechanisms including tracks to carry the modules to the aircraft parking area. A turntable arrangement may be employed with a number of terminal buildings arranged around the turntable to provide access to an aircraft on the turntable. In one specific arrangement, the modules run on

underground tracks and are lowered from the terminal building and then loaded into the aircraft from underneath.

In another aspect, therefore, the invention provides a method of loading and unloading an aircraft, in which modules designed to fit into the fuselage of an aircraft are pre-loaded with cargo or passengers away from the aircraft and the loaded modules are fitted into the aircraft fuselage and the aircraft is later unloaded by removing the loaded modules from the fuselage and emptying the modules away from the aircraft.

As indicated above, the loading and unloading may be carried out at a building remote from the aircraft and the modules transported by vehicle to and from the aircraft. Alternatively, the modules may be loaded or unloaded in a building adjacent to the aircraft.

The invention provides significant advantages in cargo and passenger handling.

Aircraft turn around can be made considerably quicker as the aircraft no longer has to wait at a terminal to be cleaned and reprovisioned between flights. Servicing may be simplified with improved access to internal areas in the empty fuselage. Freight for particular destinations can be made up in advance, the loaded module being delivered from the cargo area to the main loading facility and fitted into the first conveniently available slot. As the freight modules can be sealed after being loaded with cargo, freight originating with one airline can be more readily transported by another airline having an aircraft with available space to the desired destination. With increased flexibility to load onto an aircraft with an available space for a module, the frequency of empty or part

empty aircraft crossing, for example, the Atlantic Ocean, can be reduced, thus leading to increased revenue and fewer uneconomic flights.

Passenger baggage may conveniently be loaded into the appropriate passenger module, usually from underneath, while the passengers are embarking and, similarly, be unloaded from the module while the passengers are disembarking. In other words, the delivery point for baggage is to the module rather than to the aircraft, which will avoid unnecessary delays.

Embodiments of the invention will now be described by way of example only, with reference to the accompanying drawings in which:

Figure 1 is an elevation in part section of an aircraft according to the invention;

Figure 2 is a similar view to Figure 1 of a second aircraft according to the invention;

Figure 3 is a transverse section through a two tier passenger module;

Figure 4 is a diagrammatic representation showing a longitudinal view of the module of Figure 3;

Figure 5 is a view similar to Figure 3 showing a cargo module;

Figure 6 is a view similar to Figure 4, but of the cargo embodiment of Figure 5; and

Figure 7 is a diagrammatic representation of one mode of loading and unloading an aircraft according to the invention.

In Figure 1, aircraft 10 has a conventional shape with a forward cockpit area 11, main wings 12 (one only visible), and tail section 13. The central fuselage area 14 is essentially a hollow shell to receive identical modules 15, 16, 17 and 18. The modules may be designed to carry passengers or cargo or be a mixture of both.

The modules may be loaded through access hatches 19, 20 and 21 in the fuselage. Alternatively, or additionally, the front section of the fuselage may be hinged at 22 to provide access.

First class and/or business class accommodation may be provided underneath the cockpit at area 23, which may be a permanent layout.

The modules may have been loaded into the fuselage after being transported on a suitable transporter to the aircraft which is parked remote from the cargo/passenger loading area. They are locked into place within the fuselage. The modules contain windows in corresponding alignment with windows 24 in the fuselage. Similarly doors (not shown) in the modules may correspond with doors (not shown) in the fuselage.

In Figure 2, aircraft 30 has a forward cockpit area 31, main wings 32 and tail section 33. Central fuselage area 34 is also essentially a hollow shell to receive identical twin deck modules 35,38; 36,39 and 37;40 to provide an upper level and a lower level. Loading access for the modules into the fuselage is provided by the hinged front nose section 41, shown in the closed and (dotted) open positions. A track system 42 and 43 to receive runners/rollers on the base of each module runs the length of the fuselage to receive the upper and lower levels of modules respectively. The tracks will be at a level corresponding to equivalent tracks in the terminal building.

In Figure 3 is shown a section through two tier module 50 divided into an upper half 51 and lower half 52 by a horizontal deck 53. Upper portion 54 is shown containing seats 55 with gangways 56 and has been inserted into the upper half 51. The module is provided with additional access points 57,58 at each side which on opening retract into channel 59,60 respectively. Alternatively, the channel may be on the outside of the module.

Areas 61 in the module provide overhead baggage space and luggage space 61A is provided in the bottom of lower half 52.

A lower deck 62 in the lower half 52 provides a floor for further seating (not shown).

Tracks and runners 63,64 provide the means to move the module into and out of an aircraft fuselage and/or terminal building.

The module is shown in longitudinal view in Figure 4. Areas 65 and 66 at the front and rear provide service areas for catering, toilets and the like.

In Figures 5 and 6, a cargo module 70 is divided into upper and lower halves 71 and 72 by horizontal deck 73. The module has access points 74,75 in each half which open into recesses 76,77 respectively. As before, the access doors may be channelled to open onto the outside of the module to provide more interior space. Tracks and runners 78,79 respectively are shown.

The cargo module is shown with end doors 80 to facilitate taller loads or fork truck access.

An alternative loading arrangement is shown in Figure 7. In this arrangement, an aircraft 130 of the type shown in Figure 1 is positioned on a turntable 131. Positioned around the turntable are terminal buildings 132, 133, 134 and it will be appreciated that there may be more such buildings.

Each terminal building is connected to the turntable 131 by rail tracks 135, 136, 137 whereby modules loaded in one or more of the terminal buildings may be transported to be loaded into the fuselage of the aircraft. The modules may be transported along the tracks by a specifically designed transporter, one of which may be dedicated to each terminal building. Alternatively, one or two transporters may be dedicated to each turntable.

The aircraft can be rotated as shown by the arrows to align with the tracks for any terminal building and may, therefore, discharge modules to be unloaded into one or more

CLAIMS

1. An aircraft having a fuselage to contain a plurality of modules, each module being designed to accommodate passengers or cargo and being removable from the fuselage for loading and unloading to take place remote from the fuselage.

2. An aircraft according to Claim 1, in which the modules are of identical external dimensions.

3. An aircraft according to Claim 1 or 2, in which some of the modules are designed for cargo and some for passenger use.

4. An aircraft according to Claim 1, 2 or 3, in which the modules are passenger modules and have two or more decks.

5. An aircraft according to any preceding claim, in which the modules are passenger modules with fold-down sides whereby they may be accessed by passengers.

6. An aircraft according to any preceding claim, in which the modules are interconnected.

buildings and then rotate to receive loaded modules from one or more buildings after the aircraft has been refuelled.

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7. An aircraft according to any one of Claims 1 to 5, in which each module is a self-contained unit with catering, washroom and/or entertainment facilities.

8. An aircraft according to any preceding claim, in which the modules have doors and windows corresponding to the door and window positions in the aircraft fuselage.

9. An aircraft according to any one of Claims 1 to 7, in which the modules do not have windows and have video screens.

10. An aircraft according to any preceding claim, having a plurality of loading points into the fuselage for the modules.

11. An aircraft according to any preceding claim, in which the modules move on runners attached to the interior of the fuselage and are lockable into their required positions in the fuselage.

12. An aircraft according to any preceding claim, in which the modules are incorporated in the structural rigidity of the aircraft.

13. An aircraft module, the module having external dimensions to fit into the fuselage of an aircraft and having means to slide within the aircraft to its required position and means to lock it in that position.

14. An aircraft module according to Claim 13, which is a passenger module having two or more decks.

15. An aircraft module according to Claim 13 or 14, which is a passenger module with fold-down sides whereby it may be accessed by passengers.

16. An aircraft module according to Claim 13, 14 or 15, which has means to interconnect with an adjacent module or modules.

17. An aircraft module according to any one of Claims 13 to 16, which is a self-contained unit with catering, washroom and/or entertainment facilities.

18. An aircraft module according to any one of Claims 13 to 17, which has doors and windows located to correspond to the door and window positions of the aircraft in which it is to be fitted.

19. A method of loading and unloading an aircraft, in which modules designed to fit into the fuselage of an aircraft are pre-loaded with cargo or passengers away from the aircraft and the loaded modules are fitted into the aircraft fuselage and the aircraft is later unloaded by removing the loaded modules from the fuselage and emptying the modules away from the aircraft.

20. A method according to Claim 19, in which the loading and unloading is carried out at a building remote from the aircraft and the modules are transported by vehicle to and from the aircraft.

21. A method according to Claim 19 or 20, in which baggage is loaded into the module or unloaded from the module while passengers are embarking or disembarking respectively.

22. An aircraft according to Claim 1, substantially as hereinbefore described with reference to and as shown in Figures 1 to 6 of the accompanying drawings.

The Patent Office

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Application No: GB 9707347.2
Claims searched: 1-12

Examiner: C B VOSPER
Date of search: 30 October 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B7W(WFC,WFE,WFF)

Int Cl (Ed.6): B64C 1/00,1/22,1/30; B64D 9/00,11/00

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2190691 A	HALIM (whole document)(Equivalent = US4589612)	1,2,4,6,7 at least
A	GB 1143781	BIRD (whole document)	
A	GB 1133340	MEYER (whole document)	
X	GB 0706611	FAIREY (whole document)	1,2 at least
X	EP 0035955 A2	SCHWEIZERISCHE (whole document, but note windows 34, in figs. 3 and 4)	1,2 and 8 at least
X	WO 96/14243 A1	BE AEROSPACE (whole document, but page 10, lines 4-24, in particular)	1,2,4,6,7, 9 at least
A	US 5752673	SCHLIWA (whole document but col. 2, line 58 et seq., in particular)	1,3,6,12
X	US 5346162	BELIE (whole document)	1,2,10 at least
X	US 5090639	MILLER (whole document)	1,2,6,10, 11 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

Application No: GB 9707347.2
Claims searched: 1-12

Examiner: C B VOSPER
Date of search: 30 October 1998

Category	Identity of document and relevant passage		Relevant to claims
X	US 4071210	MUTKE (whole document but fig.2, and col. 4, lines 52-58 in particular)	1,2,4,-6,10,11 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
&	Member of the same patent family		